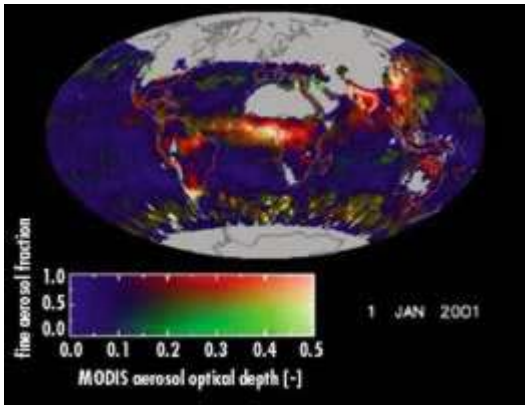
Remote-Sensing Satellites Reveal a Changing Earth

FRANK MORRING, JR./WASHINGTON

As World Space Congress convenes in Houston, an international flotilla in orbit delivers rich detail on the home planet

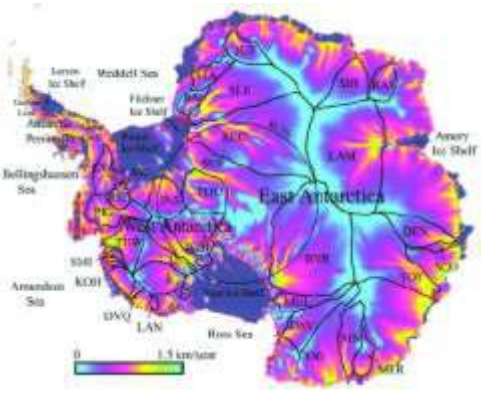
SPACE IMAGING

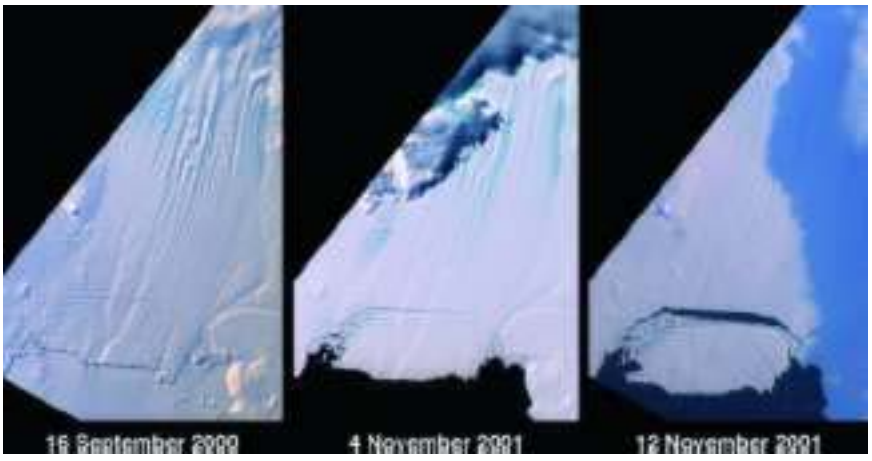
The River Elbe rages through the heart of Dresden, Germany, on Aug. 18. In this 1-meter image collected by the Ikonos commercial remote-sensing satellite from an altitude of 367 naut. mi. (see facing page), the Zwinger Palace museum (with large courtyard) and other structures on the south bank of the river are surrounded by standing water, while trees along the river bank are engulfed by waves. Earlier, the crest of some of the worst flooding in Europe in more than a century swept through central Prague as well. Satellite images like this guide the response to natural disasters, giving officials a timely picture of conditions on the ground. Worldwide, satellites are gaining in value for day-to-day practical applications while they also give scientists an unprecedented ability to track subtle changes over long periods.



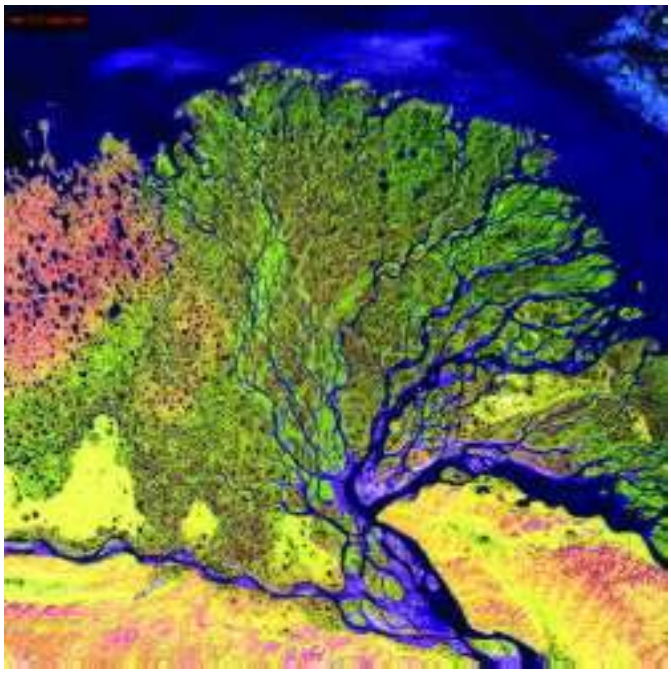
This map, created from data supplied by the Moderate Resolution Imaging Spectroradiometer (Modis) instruments on board NASA's Terra and Aqua satellites, distinguishes human pollution from dust and other natural aerosols. Smoke and other human-generated aerosols are made up of smaller particles than natural aerosols. The Modis instruments can distinguish aerosol size. The map shows aerosol particles larger than 1 micrometer in green and smaller particles--suggesting human pollution plumes--in red.

NASA scientists used data from Earth Remote-Sensing Satellites ERS-1 and -2 and Radarsat 1, along with airborne radar soundings and other data, to generate this map of 33 Antarctic glaciers. While more work is needed, scientists calculate that glaciers in eastern Antarctica are relatively stable in terms of gaining new ice inland to replace ice lost at the coast. In the west, the ice sheet seems to be losing about 65 cu. km. a year, give or take 15 cu. km. That is enough to raise sea level by 0.16 mm. a year.



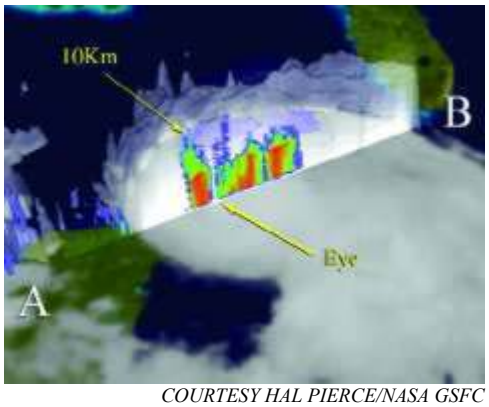


Cameras on board NASA's Terra spacecraft captured these images of an iceberg much larger than Manhattan calving from the Pine Island Glacier in West Antarctica. Measuring 42 X 17 km. (26X 11 mi.), the berg separated from the glacier sometime between Nov. 4 and Nov. 12, 2001. The first image on the left shows the glacier beginning to crack in September 2000, while the others show the glacier just before and after the iceberg formed. The massive block represents almost seven years of ice outflow from the Pine Island Glacier, which is the fastest moving ice river in Antarctica.



While rich in data useful to the Russian officials who protect the Siberian wilderness, this Landsat 7 image of the Lena River Delta also demonstrates that Earth-imaging satellites give nothing away to the Hubble Space Telescope when it comes to beautiful pictures.

Tropical Storm Isidore (right) yielded its secrets to the U.S./Japanese Tropical Rainfall Measuring Mission on Sept. 24, just as an eye was beginning to develop while the system passed through the Yucatan Strait. Red shows the heaviest rain inside the storm, while blue is light rain and white is the overall cloud and rainband structure, sliced along the cross section that runs from southwest (A) to northeast (B).

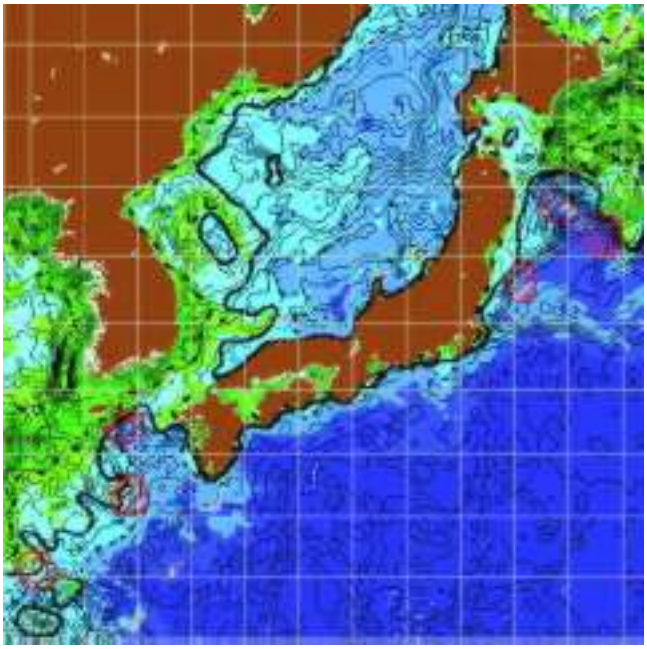


COURTESY HAL PIERCE/NASA GSFC

SPOT IMAGE PHOTOS

Satellite-generated imagery can be manipulated by computer for a variety of practical applications, from guiding farmers as they irrigate their crops to helping fast-food chains site new outlets. Here 2.5-meter-resolution imagery of San Francisco International Airport collected by France's new Spot 5 satellite has been combined with elevation data to simulate an approach to the runway. Commercial remote-sensing companies such as Spot see profits in providing terrain databases for flight simulation.

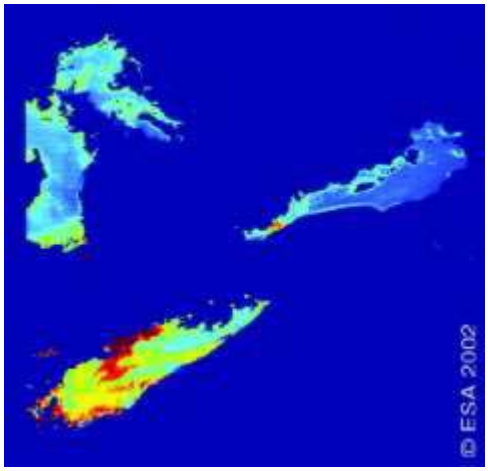
Europe's M-SAT specializes in assembling high-resolution, natural-color images of terrestrial scenes and selling them on the Internet. The company uses data from Landsat, Spot, Russia's Cosmos and the U.S. National Oceanic and Atmospheric Administration weather satellites to generate its images, like this one of Egypt showing the Nile River and its delta surrounded by desert, as well as the Sinai Peninsula to the right.



ORBIMAGE

Orbimage's SeaStar Fisheries Information Service uses data from the Sea-viewing Wide Field-of-View Sensor (SeaWiFS), on its OrbView-2 satellite to generate fish-finding maps like this one, which shows tuna hot spots (red) south of the Korean Peninsula and east of Japan's Honshu Island. Dark green signifies high concentrations of the plankton that feed the fish tuna eat, while dark blue indicates clear water. Tuna like to see what they eat, so they can often be found where clear water meets plankton along the warmer sides of thermal fronts (black lines).

The technology needed for satellite remote sensing has spread worldwide, as this "whole-Earth" weather image collected by India's new Metsat illustrates. Building on earlier spacecraft that combined weather instruments with telecommunications relays, the Indian Space Research Organization launched its first dedicated weather satellite on Sept. 12 with a Polar Satellite Launch Vehicle (PSLV-C4). The satellite carries a Very High Resolution Radiometer for imagery in the visible (shown), infrared and water vapor wavelengths. It also is equipped with a Data Relay Transponder to collect data from untended weather platforms.



Lake Huron (upper left), Lake Erie (lower left) and Lake Ontario, all on the U.S./Canadian border, glow with fluorescence from phytoplankton in this image from the European Space Agency's Envisat. The redder the signal from the lakes, the stronger the phytoplankton fluorescence. The image was collected with Envisat's Medium Resolution Spectrometer, and demonstrates that the instrument can fulfill a requirement to detect weak phytoplankton fluorescence from space. Scientists will use the data to study bio- and geochemical cycles and the roles they play in regulating climate.

Aviation Week
A Division of The McGraw-Hill Companies